THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

071 BIOLOGY 2

ALTERNATIVE TO PRACTICAL

(For Both School and Private Candidates)

Time: 2:30 Hours **ANSWERS** **Year: 2015**

Instructions

1. This paper consists of sections Five questions. Answer all questions

2. Each question carries ten marks.

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1. In an experiment five sets of three bean seeds each were used. The first set contained dry bean seeds and were placed in glass jar labeled A. The remaining four sets were soaked in water overnight and placed separately in each of the four glass jars labeled B, C, D, and E. The contents of the five glass jars were varied as shown in the Table 1 below.

Table 1

S/N	Glass Jar	Contents of the Glass Jar
1	A	Dry cotton wool and three bean seeds kept at 25°C.
2	B	Three bean seeds, wet cotton wool and a mixture of pyrogallol acid and NaOH contained in the test tube which is suspended in the jar by a rubber stopper and the jar is stopped and kept at 25°C.
3	C	Three bean seeds and wet cotton wool kept at 25°C.
4	D	Three bean seeds and wet cotton wool kept at 60°C.
5	E	Three bean seeds and wet cotton wool kept at 5°C.

1(a). What was the aim of the experiment?

The aim of the experiment was to investigate the conditions necessary for seed germination. Specifically, it aimed to determine the effects of moisture, oxygen, and temperature on the germination of bean seeds.

(b). State with reason(s) what was observed to the seeds in each glass jar.

1. Jar A (Dry cotton wool and three bean seeds kept at 25°C)
   - Observation: The seeds did not germinate.
   - Reason: The dry cotton wool provided no moisture, which is essential for the activation of enzymes necessary for germination. Without water, metabolic processes like hydrolysis of stored food could not occur, preventing growth.
2. Jar B (Three bean seeds, wet cotton wool, and a mixture of pyrogallol acid and NaOH contained in the test tube which is suspended in the jar by a rubber stopper and the jar is stopped and kept at 25°C)
   - Observation: The seeds did not germinate.
   - Reason: Pyrogallol acid and NaOH absorbed oxygen from the jar, creating an anaerobic environment. Oxygen is essential for aerobic respiration, which provides the energy required for germination. Without oxygen, the seeds could not generate enough ATP to sustain cell division and growth.

3. Jar C (Three bean seeds and wet cotton wool kept at 25°C)
   - Observation: The seeds germinated normally.
   - Reason: The seeds had all necessary conditions for germination: moisture from the wet cotton wool, oxygen from the air, and an optimal temperature of 25°C. These conditions allowed enzymatic activities to proceed, enabling the breakdown of stored food into usable energy for growth.

4. Jar D (Three bean seeds and wet cotton wool kept at 60°C)
   - Observation: The seeds did not germinate.

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- Reason: The high temperature of 60°C likely denatured the enzymes necessary for metabolism. Enzymes involved in seed germination function within an optimal temperature range, and excessive heat can deactivate them, preventing metabolic reactions.

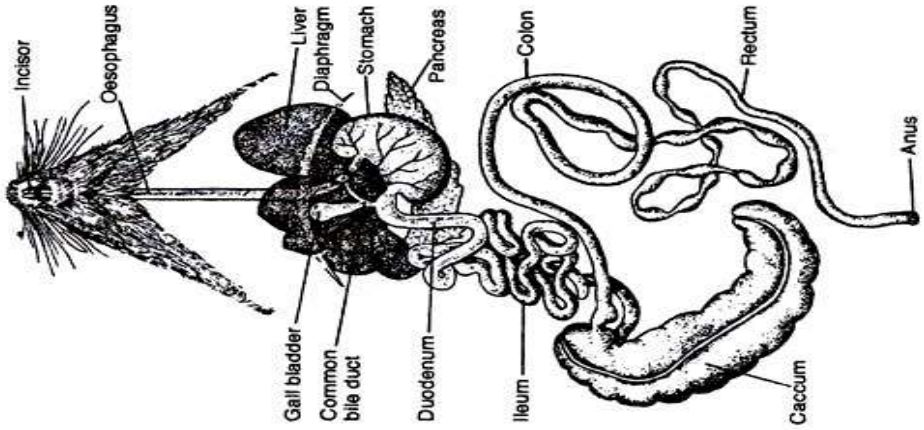
5. Jar E (Three bean seeds and wet cotton wool kept at 5°C)
- Observation: The seeds did not germinate or showed very slow germination.
- Reason: The low temperature of 5°C slowed down enzymatic activities, reducing the rate of metabolism and preventing proper germination. At such a low temperature, seed metabolism is too slow to support active growth.

2(a). Draw a diagram of a dissected rat/mouse to show the alimentary canal and label the parts where each of the following digestive processes takes place:

(i) Grinding of food
(ii) Storage of bile
(iii) Temporary storage of food
(iv) Digestion and absorption of digested food
(v) Absorption of water
(vi) Egestion

Answer: The alimentary canal of a rat or mouse includes the mouth, esophagus, stomach, small intestine, large intestine, and anus.

- Grinding of food takes place in the mouth, where teeth help break down food.
- Storage of bile occurs in the gall bladder, which releases bile into the small intestine to aid fat digestion.
- Temporary storage of food happens in the stomach, where food is mixed with digestive juices.
- Digestion and absorption of digested food occur in the small intestine, where enzymes break down food and nutrients are absorbed.
- Absorption of water takes place in the large intestine, which reabsorbs water and minerals.
- Egestion occurs at the anus, where undigested waste is expelled.



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(b). State four adaptations shown by the structure labeled in (a)(iv) above for absorption of digested food materials.

The small intestine is adapted for the absorption of digested food in the following ways:

1. Presence of villi and microvilli that increase the surface area for maximum absorption.
2. Thin epithelial lining that allows quick diffusion of nutrients into blood capillaries.
3. Rich blood supply that helps transport absorbed nutrients efficiently.
4. Presence of lacteals that absorb fatty acids and glycerol from digested fats and transport them through the lymphatic system.

3. You are provided with a list of four different organisms named termite, coconut plant, peas and tick. Answer the following questions:

(a). Classify the organisms to class level.
Termite
- Kingdom: Animalia
- Phylum: Arthropoda
- Class: Insecta

Coconut plant
- Kingdom: Plantae
- Phylum: Angiospermatophyta (or Magnoliophyta)
- Class: Monocotyledonae

Peas
- Kingdom: Plantae
- Phylum: Angiospermatophyta (or Magnoliophyta)
- Class: Dicotyledonae

Tick
- Kingdom: Animalia
- Phylum: Arthropoda
- Class: Arachnida

(b). State four distinctive characteristics of the class to which peas belong.
Peas belong to the class Dicotyledonae, which is characterized by:

1. Presence of two cotyledons in the seed.
2. Reticulate venation in leaves (net-like pattern).
3. Presence of a taproot system instead of fibrous roots.
4. Flowers arranged in multiples of four or five.

4. The following is a list of six organisms named rat, grasshopper, mango tree, fish, lizard and bird.

(a)(i). Name the structure(s) used by each organism listed above for gaseous exchange.

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- Rat: Lungs
- Grasshopper: Tracheal system
- Mango tree: Stomata and lenticels
- Fish: Gills
- Lizard: Lungs
- Bird: Lungs and air sacs

(ii). State four adaptations shown by the structure used by rat for gaseous exchange.

The lungs of a rat are adapted for gaseous exchange in the following ways:

1. Large surface area due to numerous alveoli for efficient gas exchange.
2. Thin alveolar walls that allow easy diffusion of oxygen and carbon dioxide.
3. Rich blood supply with capillaries to transport oxygen and remove carbon dioxide.
4. Moist surface inside the alveoli to facilitate gas diffusion.

(b). Explain how does each of the following factors affect the rate of respiration in organisms:

(i) Age: Younger organisms have a higher respiration rate due to active growth and higher metabolic activities. As organisms age, their metabolism slows down, reducing the rate of respiration.

(ii) Health: A healthy organism has an efficient respiratory and circulatory system, leading to a higher rate of respiration. Diseases affecting the lungs, heart, or metabolic processes reduce respiration efficiency.

5(a)(i). Name the parts labeled H, I, J, K, L and M.

- H: Neural spine
- I: Transverse process
- J: Centrum
- K: Neural canal
- L: Prezygapophysis
- M: Postzygapophysis

(ii). State one function played by each structure labeled J, L and M.

- J (Centrum): Provides structural support and bears body weight.
- L (Prezygapophysis): Allows articulation with the vertebra above for movement.
- M (Postzygapophysis): Allows articulation with the vertebra below to provide stability.

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(b). State three functions of the human skeleton.

- Provides structural support and shape.
- Protects vital organs like the brain, heart, and lungs.
- Facilitates movement by providing attachment points for muscles.

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